

AGU ABSTRACT

CORONAL FARADAY ROTATION OBSERVED WITH THE DEEP SPACE NETWORK AND THE MAGELLAN SPACECRAFT

Sami W. Asmar

This paper describes an experimental technique to measure the Faraday rotation in the solar corona using a Venus-orbiting spacecraft and the deep space network at 3.6 cm and 13 cm wavelength radio signals. Performed for the first time with unique features in the spacecraft and ground station configuration, it demonstrated the capability to perform valuable solar science without additional costly instrumentation development. The Faraday Rotation effect, observed when a linearly polarized electromagnetic wave travels through the Sun's magnetized hot atmosphere and is rotated in its plane of polarization, reveals information about the coronal magnetic field. The Magellan spacecraft transited radio signals to Earth that are 100% linearly polarized at 13 cm wavelength and right-hand circularly polarized at 3.6 cm wavelength with a strong left-hand circularly polarized component. During the summer of 1992, Magellan entered a superior conjunction period and came as close as 0.6 solar radii from the Sun's center as viewed from Earth. The signals propagating from the spacecraft to earth traveled through the solar corona and were received by the 70-meter diameter ground antennas equipped with instrumentation that simultaneously received the four channels of interest; the right and left-hand components of the two signals. The data were processed by digital phase-locked loop software and the phase difference between the right and left-hand polarization components were measured. Combined with information on the electron density, the data were used to examine the mean behavior of the coronal magnetic field.